

Short Report

## Assessing changes in pupillary size in Rifian smokers of kif (*Cannabis sativa* L.)<sup>☆</sup>

A. Merzouki<sup>a,\*</sup>, J. Molero Mesa<sup>a</sup>, A. Louktibi<sup>b</sup>, M. Kadiri<sup>b</sup>, G.V. Urbano<sup>c</sup>

<sup>a</sup> *Flora, Vegetation and Ethnobotany Group, Department of Botany, Faculty of Pharmacy Campus de Cartuja, 18071 Granada, Spain*

<sup>b</sup> *Department of Biology, Faculty of Sciences, UAE Tétouan, Morocco*

<sup>c</sup> *Department of Physiology, Faculty of Pharmacy Campus de Cartuja, 18071 Granada, Spain*

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### Abstract

Although the measurement of eye pupil variations is a common method in the only few cannabis effect research, there are no studies on short term effects of kif (Moroccan traditional preparation of cannabis) on eye pupil. The aim of the present paper is to present results about effect of a smoked kif preparation (*Cannabis sativa* L.) on pupil diameter variations after 30 mn.

Two examiners measured the pupil diameter variations before and after kif smoking in 34 eyes of 17 volunteer-consumers in a dark closed room. Pupil diameter was estimated by Colvard pupillometer.

Results reveal a significantly increase in pupil size post kif.

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**Keywords:** Kif; Cannabis; Pupil size; Colvard pupillometer; Morocco

### 1. Introduction

Previous ethno botanical studies undertaken in the Rif mountains (North of Morocco) about traditional therapeutic uses reveal that the local population possess a rich knowledge of phytomedicinal remedies preparations.<sup>1</sup>

*Cannabis sativa* L. (Cannabaceae) has been utilized in ethno medicine for millennia. Ethno botanical studies have examined its application in Moroccan phytotherapy.<sup>2–4</sup> Previous field studies were performed in Morocco with the Scotopic Sensitivity Tester-1 (SST-1) in subjects before and after smoking kif. In test situations, improvements in night vision were observed after smoking kif. It is believed that this effect is dose-dependent and cannabinoid-mediated at the retinal level.<sup>5</sup>

Reported cannabis effects on pupil size have been controversial, ranging from reports of slight pupillary constriction after smoking<sup>6</sup> to variable responses in pupil size post cannabis at low or high dose.<sup>7</sup> Fant et al.<sup>8</sup> reported that the pupillary light reflex decreased following active dose administration of cannabis and concluded as a new finding, that smoking acutely produced decrements in smooth pursuit eye tracking. In other studies,<sup>9,10</sup> authors noted that pupil diameter tend to decrease after cannabis exposure.

In this paper, we examine data of pupil diameter variations in four classes of kif smokers employing objective measures with a scientifically standardized technique.

### 2. Materials and methods

This research was performed as part of a larger study of the ethnopharmacological potential of cannabis, based upon ethnobotanical knowledge as background. kif was and still be the traditional manner of smoking psychotropic cannabis in the Rif area. kif is prepared from the female flowering tops of cannabis, which are harvested at plant

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\* Corresponding author. Fax: +34 958243912.

E-mail address: [merzouki@ugr.es](mailto:merzouki@ugr.es) (A. Merzouki).

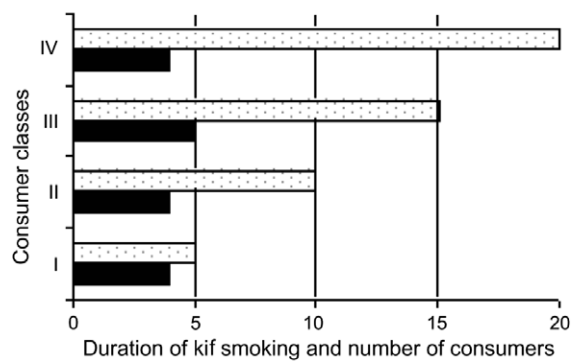


Fig. 1. Classes of kif consumer: (■) consumers number and (□) duration of kif consumption (years).

maturity, dried, and conserved in plastic bags (Fig. 2). This harvest is then mixed in a standard, generationally transmitted ratio with tobacco (*Nicotiana rustica* L.) leaves. The mix is then cut finely to give the final smoked product, kif. Traditionally, cannabis leaves are never smoked alone in this region.<sup>3</sup>

Seventeen informant-consumers, all males over 24 years of age who are considered as a habitual consumers were recruited for the study. They were distributed into four classes of consumers according to the number of years of kif consumption (less than 5 years, 5–10 years, 10–15 years and 15–20 years) (Fig. 1). Smokers group were carefully selected to be free of clinical signs of eye disease.

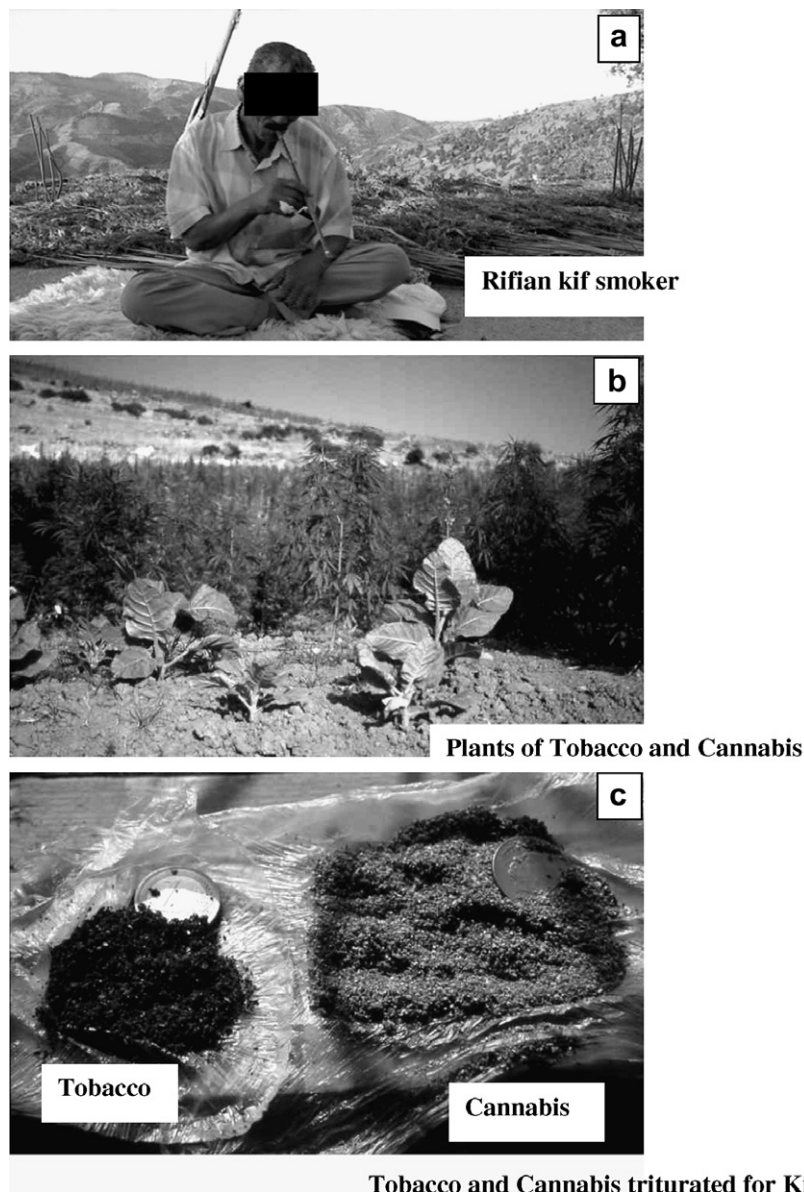


Fig. 2. Kif consumer (a), *Cannabis sativa* and *Nicotiana rustica* crops (b) and kif mixture preparation (c).

Table 1

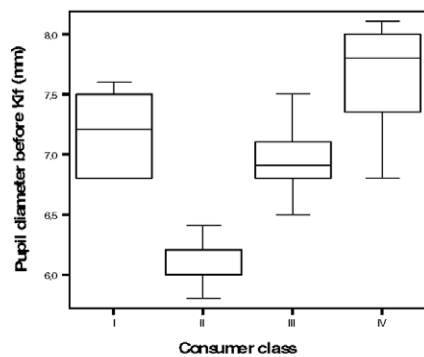
Paired samples test of pupil diameter sizes after smoking kif in 34 eyes at 95% confidence interval of the difference

Statistic for paired samples					Paired samples test								
					Paired differences								
Pair	Mean	N	SD	SE mean	Pair	Mean difference	SD	SE mean	95% confidence interval of the difference		t	df	Sig. (2-tailed)
									Lower	Upper			
PDBK	6.956	34	0.6491	0.1113	PDBK–DPAK	−0.1559	0.1106	0.0190	−0.1945	−0.1173	−8.217	33	0.000
PDAK	7.112	34	0.6646	0.1140									

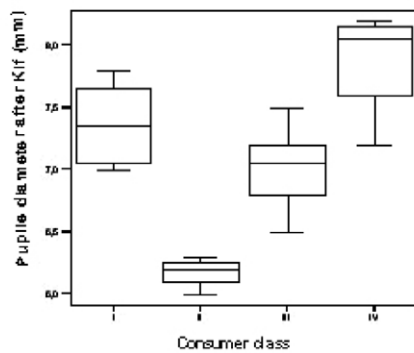
PDBK, pupil diameter before kif.

PDAK, pupil diameter after kif.

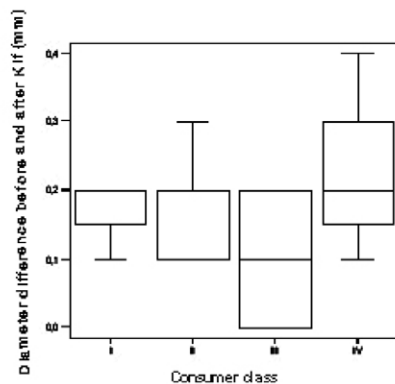
N, number of samples; SD, standard deviation; SE mean, standard error mean and df, fidelity degree.

**A. Size variations of pupillary diameter in four classes of consumers before smoking kif (Cannabis sativa L.)**

Anova table		Sum of squares	Df	Mean square	F	Sig.
Before*classes	Between groups	10,453	3	3,484	30,289	,000
	Within groups	3,451	30	,115		
	Total	13,904	33			

**B. Size variations of pupillary diameter in four classes of consumers 30mn after smoking kif (Cannabis sativa L.)**

Anova table		Sum of squares	Df	Mean square	F	Sig.
After*classes	Between groups	11,717	3	3,906	40,898	,000
	Within groups	2,859	30	,095		
	Total	14,575	33			

**C. Mean difference in pupil size in four classes of kif**

Anova table		Sum of squares	Df	Mean square	F	Sig.
Difference*classes	Between groups	,063	3	,021	3,025	,045
	Within groups	,208	30	,007		
	Total	,27	33			

Fig. 3. Anova data analysis of pupil size means in four consumer classes: (a) before smoking kif, (b) after smoking kif and (c) mean difference analysis of pupil size before and after smoking kif in the four consumer classes.

During experimental sessions, informants smoked four traditional pipes (called “SEBSI”) containing  $78.588 \text{ mg} \pm 0.006 \text{ mg}$  of kif per pipe.

Pupillary size was measured before and 30 min after smoking kif using a hand Colvard pupillometer.

Subjects were examined in a closed room ( $4 \times 2.5 \text{ m}^2$ ) in controlled night conditions. Patients were seated comfortably in front of the pupillometer. Accommodation was controlled by instructing the subject to view a distant fixation light spot projected at 3.5 m. Two examiners measured each patient before and after smoking kif.

### 3. Results and discussion

The iris of the eye is embedded with tiny muscles that dilate and constrict the pupil size. The sphincter muscle lies around the very edge of the pupil. In bright light, the sphincter contracts, causing the pupil to constrict. The dilator muscle runs radially through the iris, like spokes on a wheel. This muscle dilates the eye in dim lighting.

Pupil diameter variations measured in the four classes of kif consumers (34 eyes, 17 subjects) established no significant difference between left and right eye after smoked cannabis. This fact suggests that the effect of cannabis on pupil dilatation is bilateral, akin to that of the photo-motor reflex (consensual reflex). Analysis of all measures at 95% confidence interval of the difference (Table 1) shows that pupil diameter before kif varied from 6.729 mm to 7.182 mm (mean 6.956 mm). Thirty minutes after smoking kif, the measured pupil diameter varied from 6.880 mm to 7.344 mm (mean 7.112 mm). The analysis of variance indicates a statistically significant difference between means of control and post kif pupil diameter. It is clear that smoking kif causes a significant dilatation of pupil diameter after 30 min in our experimental conditions. This change, which may be mediated through sympathetic stimulation, is not of a magnitude that would allow its observation with the naked eye, however.

Comparison of data for pupil dilatation between the four consumer classes reveals that long-term users of kif are statistically significantly distinct from the other classes of less chronic duration (Fig. 3). These results support our unpublished observations, that cannabis can induce mydriasis in heavy chronic consumers of cannabis. In line with that, Raman and Jacob<sup>11</sup> reported that some plants and plant products caused mydriasis; these authors argued that “Although accidental mydriasis is commonly due to parasympatholysis it may also occur secondary to increased adrenergic stimulation”, no reference to cannabis effects was cited in this paper.

Cannabinoid type-1 (CB1) receptors are particularly abundant in the human retina,<sup>12–14</sup> and constitute a potential mediator of kif induced of pupil dilatation.

Excitation of the retina may affect pupil size through the afferent optic nerve/Edinger-Westphal nucleus pathway and efferent Edinger-Westphal/ciliary ganglion pathway; postganglionic fibres then innervate pupillary sphincter muscles.

Cilio-spinal center fibres also converge upon the ciliary ganglion, and supply the afferent way with sympatric stimulus to dilating muscles of pupil.

The present work demonstrate for the first time a significant dilatation of eye pupil in cannabis users upon smoking kif preparation. These data support evidence of implication of cannabinoid in modulating functions of the visual system and corroborate our previous results showing that cannabis smoking favoured night vision.<sup>5</sup>

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